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(71) Applicant *(for all designated States except US)*: COMPACTION TECHNOLOGY (SOIL) LIMITED [GB/GB]; Sydney De Leon of Talbot House, 204–226 Imperial Drive, Harrow, Middlesex HA2 7HH (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: COOK, Eric, Johnstone [ZA/ZA]; 57 Somerset Street, Ferryvale, Nigel 1491 (ZA). MIJBURGH, Christoffel, Avril [ZA/ZA]; 13 Fairbridge Street, Farrarmere, Benoni 1501 (ZA).

(74) Agents: MARCHANT, James, Ian et al.; Elkington and Fife, Prospect House, 8 Pembroke Road, Sevenoaks, Kent TN13 1XR (GB).

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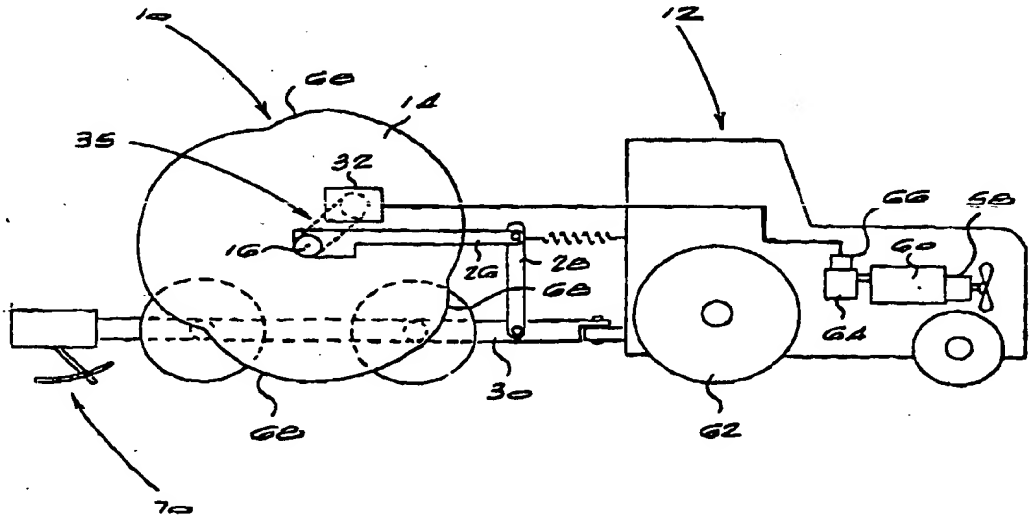

(57) Abstract

The invention concerns an impact compactor (10) which comprises one or more out–of–round compactor masses (14). The masses are moved rotationally over a soil surface, at an angular velocity suitable for normal operation, to apply periodic compaction blows to the soil surface. This is achieved by primary drive means. In the case of a towed impact compactor, the primary drive means is typically a tractor. The impact compactor (10) includes an auxiliary drive which is arranged to operate automatically, in response to a reduction of the angular velocity of the compactor masses below the angular velocity suitable for normal operation, to apply an auxiliary rotary drive that restores their angular velocity.

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IMPACT COMPACTOR

BACKGROUND TO THE INVENTION

THIS invention relates to impact compactors.

The term "impact compactor" refers to a soil compaction machine which incorporates a rotatable, out-of-round mass that produces a series of impact blows to the soil surface when towed or otherwise driven over that surface. The compactor mass of an impact compactor has multiple sides defining a series of spaced apart salient points on its periphery, each salient point being followed by a compacting face. As the mass is towed or otherwise driven over the soil surface, it rises up on each salient point and then falls forwardly and downwardly as it passes over that point, with the result that the following compacting face applies an impact blow to the soil surface. The action of the mass is therefore to store potential energy as it rises up on each salient point and then to deliver this energy as an impact blow.

Impact compactors as described above have been found to work well in practice in achieving high levels of soil compaction, even at substantial depths below the soil surface. Problems may however be encountered in situations where the salient points tend to dig in or slide relative to the soil surface, with the result that the rotational speed of the compactor mass is reduced below normal levels, adding resistance to forward motion of the impact compactor. The problem can be compounded in situations where the impact compactor incorporates a trailing levelling blade to level the compacted soil, because the inclusion of a levelling blade also increases the resistance to forward motion of the impact compactor.

SUMMARY OF THE INVENTION

According to the present invention there is provided an impact compactor comprising at least one out-of-round compactor mass which in use is movable rotationally by primary drive means, at an angular velocity suitable for normal operation, over a soil surface to apply periodic compaction blows to the soil surface, the impact compactor including auxiliary drive means arranged to operate automatically, in response to a reduction of the angular velocity of the, or each, compactor mass below an angular velocity suitable for normal operation, to apply an auxiliary rotary drive to the, or each, compactor mass to restore its angular velocity to that suitable for normal operation.

Although other types of auxiliary drive are within the scope of the invention, the preferred auxiliary drive means comprises a hydrostatic drive powered by the primary drive means and control means, which is responsive to the angular velocities of the compactor mass and of driven, ground engaging wheels of the primary drive means, for controlling the operation of the hydrostatic drive. The hydrostatic drive conveniently comprises an hydraulic motor powered by an hydraulic pump which is driven in use by the primary drive means, the hydraulic motor being arranged to drive the, or each, compactor mass by chain drive means. In this arrangement, the control means may comprise a proportional valve which regulates the flow of hydraulic fluid from the hydraulic pump to the hydraulic motor under the control of a sensor and associated electronics sensitive to the angular velocities of the compactor mass and of driven, ground engaging wheels of the primary drive means.

The invention extends to a dual mass impact compactor comprising a pair of spaced apart compactor masses mounted fast on a common shaft for synchronous rotation. In this case, the compactor masses are typically mounted on hubs at the ends of the common shaft and the chain drive means comprises a first sprocket driven by the hydrostatic motor, a chain passing about the first sprocket and about a second sprocket fast on an auxiliary shaft and means for driving the hubs off the auxiliary shaft. Such means may conveniently comprise third sprockets fast with the auxiliary shaft and meshing with fourth sprockets fast with the hubs.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of the chain drive and associated components of an auxiliary drive arrangement of an impact compactor according to the present invention, with the chain itself omitted in the interests of clarity of illustration;

Figure 2 shows a partially diagrammatic plan view of the chain drive and associated components seen in Figure 1;

Figure 3 shows a partially diagrammatic side view of the chain driven and associated components seen in Figure 1;

Figure 4 diagrammatically illustrates an impact compactor which incorporates the chain drive and associated components of the preceding Figures.

DESCRIPTION OF A PREFERRED EMBODIMENT

Figure 4 diagrammatically illustrates an impact compactor 10 according to the invention. In this case, the impact compactor 10 is arranged to be towed by a prime mover in the form of a tractor 12, but it will be understood that the invention is also applicable to impact compactors which are self-propelled, i.e. which incorporate their own prime mover.

In this embodiment, the impact compactor 10 includes a pair of three-sided compactor masses 14 of conventional design. The masses 14 are mounted fast on a common shaft 16 which forms part of a tube axle assembly 18 seen in plan in Figure 2. The tube axle assembly 18 includes a tube 20 to which a draglink 26 is connected, as illustrated. As shown diagrammatically in Figure 4, the draglink 26 is connected by a droplink 28 (Figure 4) to a wheeled carriage 30 which is hitched to the tractor 12.

Those skilled in the art of impact compaction will recognise that the towed impact compactor 10, as thus far described, is of conventional design. It will also be appreciated that the traction assembly including the draglink and droplink is resilient in nature to absorb shock loading when the compactor masses are towed over the soil surface and apply impact blows thereto. Reference may be made to the disclosure in, for instance, WO 94/26985 for further details of the traction assembly for the compactor masses.

What is not conventional about the impact compactor 10 is the inclusion of an auxiliary drive arrangement. This arrangement includes a positive displacement hydraulic motor 32 mounted on a mounting plate 33 connected to the draglink 26, and a chain drive indicated diagrammatically in Figure 4 by the numeral 35. Referring to the more detailed views of Figures 1 to 3, the chain drive includes a sprocket 34 mounted on the output shaft of the motor 32. A chain 36, represented diagrammatically in Figures 2 and 3 by a broken line, passes around the sprocket 34 and around a sprocket 38 mounted on a shaft 40 which is parallel to and above the shaft 16 and which is supported in inner and outer bearings 42 and 44 carried by the tube 20 of the tube axle assembly 18.

The ends of the shaft 40 carry sprockets 46. Further chains 47 pass around the sprockets 46 and around sprockets 48 connected to hubs 50 on which the compactor masses 14 are mounted. The masses 14 are omitted from Figures 1 to 3 in the interests of clarity of illustration. The chain drive 35 also includes chain tensioners 52, 53 and 54 to maintain proper tension in the chains 36 and 47 and an idler sprocket assembly 56.

Referring again to Figure 4, the motor of the tractor motor is indicated with the reference numeral 58 and the transmission with the numeral 60. Driven wheels of the tractor are indicated with the numeral 62.

A variable displacement hydraulic pump 64 of conventional swash plate type is driven off the transmission 60. The pump 64 supplies hydraulic fluid to the motor 32 under the control of a proportional valve 66 coupled to a sensor and associated electronic control (not shown) sensitive to the rotational, i.e. angular velocity, of the masses 14 and the driven wheels 62.

In normal operation, hydraulic fluid is pumped continuously to the motor 32 by the pump 64. If the sensor senses a rotational velocity mismatch between the compactor masses and the driven wheels 62, i.e. the wheels turn faster than the compactor masses, the valve 66, under electronic control, increases the rate of flow of hydraulic fluid to the motor 32. Via the chain drive mechanism, the hydraulic motor 32 accordingly exerts additional rotational torque on the compactor masses and accelerates them rotationally so that their rotational velocity catches up with that of the wheels 62.

A velocity mismatch may, for instance, occur if one or other of the compactor masses digs into or slips relative to the soil surface rather than rotating about the next salient point, indicated in Figure 4 with the numeral 68, or if the action of a trailing levelling blade, indicated diagrammatically in Figure 4 with the numeral 70, should excessively increase resistance to forward motion of the impact compactor.

As soon as the velocities have been matched again, the valve 66 decreases the supply of hydraulic fluid to the motor 32 to normal levels, and normal progress of the compactor masses resumes.

It will thus be appreciated that the impact compactor 10 has a hydrostatic drive control which automatically supplies extra rotary power to the compactor masses in the event of a velocity mismatch.

The sprocket 38 is mounted on the shaft 40 via a unidirectional clutch 72 which transmits rotary motion in one direction only and which freewheels in the other direction.

With this feature, it is not possible for the compactor masses to drive the tractor should their rotational speed exceed that of the wheels 62. This may, for instance, happen when the masses fall forwardly as they pass over the salient points.

In the above description the auxiliary drive is hydrostatic in nature. However it should be appreciated that the principles of the invention are equally applicable to other forms of auxiliary drive, including purely mechanical or electro-mechanical arrangements. The chain drive could be replaced by any other suitable system including, for instance, independent hydraulic drives at the hubs of the compactor masses. It should also be noted that the invention is not limited in scope to use with towed compactor masses and is equally applicable to self-propelled impact compactors incorporating their own prime movers.

CLAIMS

1.

An impact compactor comprising at least one out-of-round compactor mass which in use is movable rotationally by primary drive means, at an angular velocity suitable for normal operation, over a soil surface to apply periodic compaction blows to the soil surface, the impact compactor including auxiliary drive means arranged to operate automatically, in response to a reduction of the angular velocity of the, or each, compactor mass below an angular velocity suitable for normal operation, to apply an auxiliary rotary drive to the, or each, compactor mass to restore its angular velocity to that suitable for normal operation.

2.

An impact compactor according to claim 1 wherein the auxiliary drive means comprises a hydrostatic drive powered by the primary drive means and control means, which is responsive to the angular velocities of the compactor mass and of driven, ground engaging wheels of the primary drive means, for controlling the operation of the hydrostatic drive.

3.

An impact compactor according to claim 2 wherein the hydrostatic drive comprises an hydraulic motor powered by an hydraulic pump which is driven in use by the primary drive means, the hydraulic motor being arranged to drive the, or each, compactor mass by chain drive means.

4.

An impact compactor according to claim 3 wherein the control means comprises a proportional valve which regulates the flow of hydraulic fluid from the hydraulic pump to the hydraulic motor under the control of a sensor and associated electronics sensitive to the angular velocities of the compactor mass and of driven, ground engaging wheels of the primary drive means.

5.

An impact compactor according to either one of claims 3 or 4 comprising a pair of spaced apart compactor masses mounted fast on a common shaft for synchronous rotation.

6.

An impact compactor according to claim 5 wherein the compactor masses are mounted on hubs at the ends of the common shaft and the chain drive means comprises a first sprocket driven by the hydrostatic motor, a chain passing about the first sprocket and about a second sprocket fast on an auxiliary shaft and means for driving the hubs off the auxiliary shaft.

7.

An impact compactor according to claim 6 wherein the means for driving the hubs off the auxiliary shaft comprises third sprockets fast with the auxiliary shaft and meshing with fourth sprockets fast with the hubs.

8.

An impact compactor according to any one of the preceding claims wherein the impact compactor is hitchable in use to a tractor which serves as the primary drive means.

9.

An impact compactor according to any one of claims 1 to 7 wherein the impact compactor incorporates its own primary drive means.

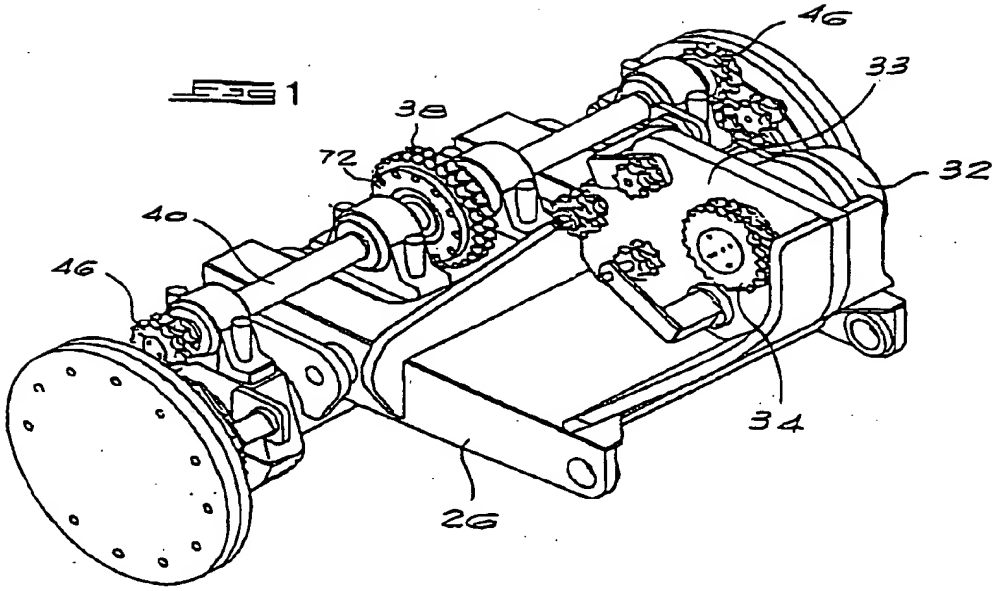
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Fig 1

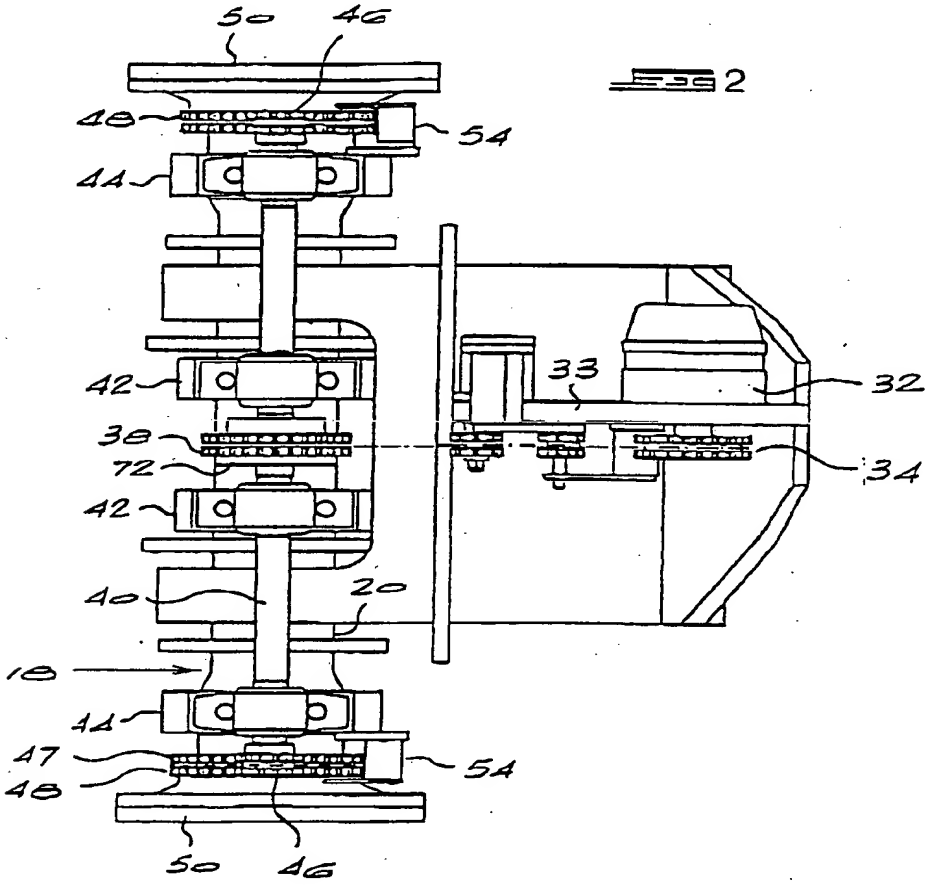
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Fig 2

FIG 3

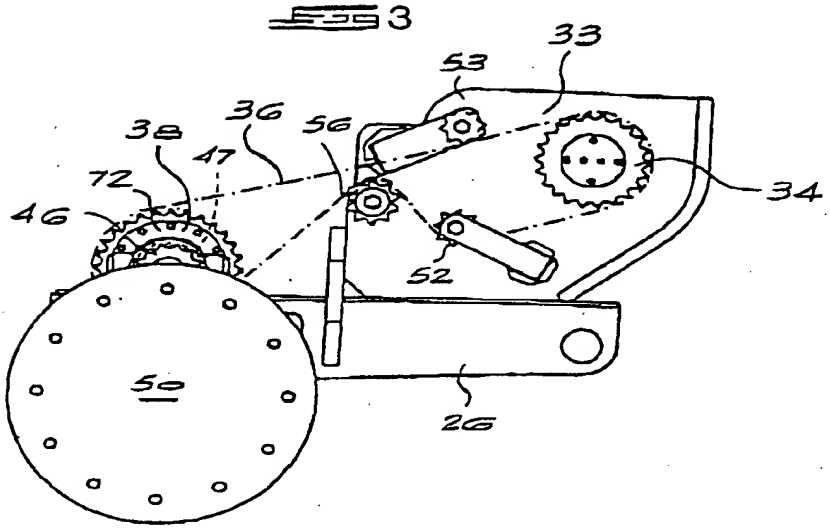
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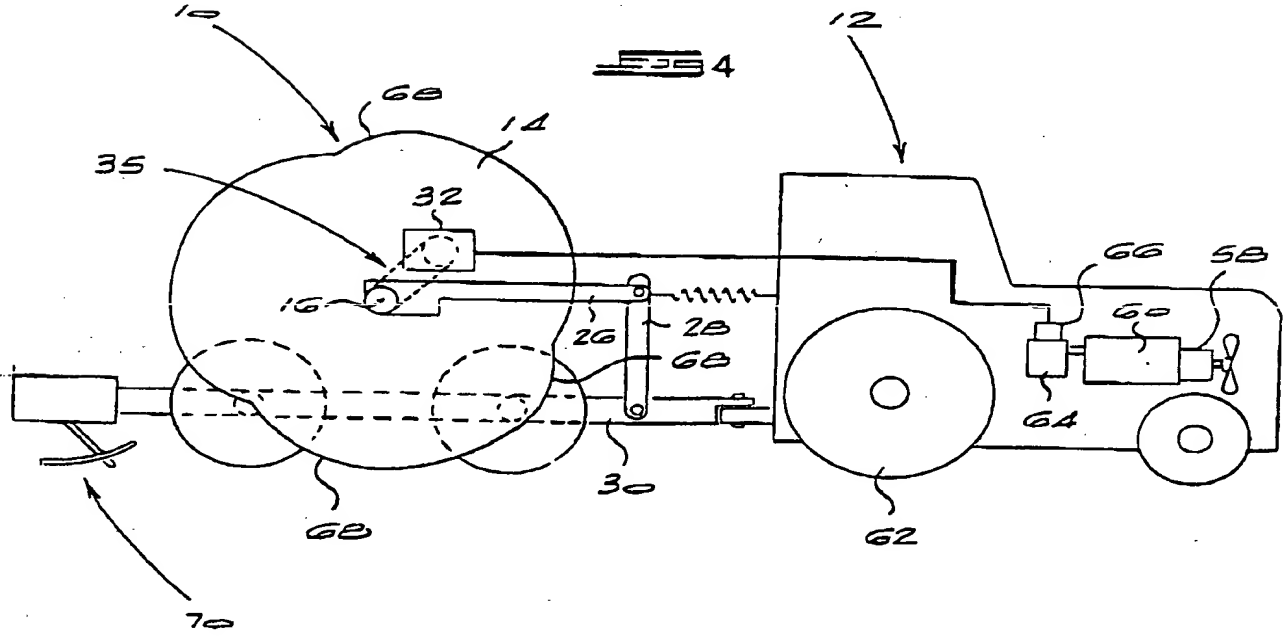
FIG 4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INTERNATIONAL SEARCH REPORT

Ir ational Application No
PCT/GB 98/01400

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E02D3/026

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E02D E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94 26985 A (COMPACTION TECH SOIL LTD ;BERRANGE AUBREY R (GB)) 24 November 1994 see page 6, line 11 - page 10, line 20; figures 1,2 ---	1
A	WO 96 14474 A (COMPACTION TECH SOIL LTD ;BERRANGE AUBREY R (GB)) 17 May 1996 see page 8, line 14 - page 13, line 12; figures 1-4 -----	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

In tional Application No
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